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Original Article

Effect of Implementing Initial Neuroprotective Nursing Care on Outcomes of Traumatic Brain Injury Patients

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Abstract:

***Background*:** Traumatic brain injury (TBI) is the most leading cause of mortality and disability worldwide, with long-term complication. Implementing initial neuro-protective nursing care could improve the results for TBI patients. **Aim**: The study aimed to assess the effect of implementing initial neuroprotective nursing care on outcomes of TBI patients**. Method**: This study was carried out at the emergency department of the Emergency Hospital, Mansoura University, using a quasi-experimental research method. 78 patients composed of a convenience sample, 39 of whom were in the study group and 39 of whom were in the control group, of both genders who aged more than or equal 18 years, and admitted to the previously setting were included. Data was gathered using a single tool of initial traumatic brain injury patients' assessment tool. **Results**: it revealed a significant improvement in the GCS of the study group (8.48± 1.50) after the implementation of the intervention than that of the control group (7.35±1.47) also there was a statistically significant differences between both studied TBI groups post-intervention as regards pupil equality (P <0.001), pupil size (P =0.026), and the pupil reaction to light (P<0.001) and all physiological parameters (P≤0.001)**. Recommendations**: It is recommended to integrate initial neuro-protective nursing care on the emergent care of TBI patient. Additionally, evaluation of the long-term effects on TBI patients in varied contexts of the initial neuro-protective nursing care.

Key terms: Initial neuro-protective nursing care, Traumatic brain injury, Patients outcomes

Introduction

There is a significant public health burden associated with traumatic brain injury (TBI), which has the highest prevalence of all common neurological disorders. TBI is becoming more and more well-documented as a chronic disease with long-term effects, including an elevated risk of

late-onset neurodegeneration, in addition to an acute condition **(Andrew, et al., 2022).** According to research, between 3.2 and 5.3 million Americans (or even more than 1.1% of all US residents) were admitted as a result of a mild to severe TBI, and approximately 40% of those individuals experience protracted impairment. **(Akira, Yuichi, Tomotaka, Takaaki, Kenichi and Chimi, 2022)**

Traumatic brain injury can manifest in a variety of ways, from mild changes in consciousness to persistent comatoseness and death. The entire brain is impacted by a diffuse type of swelling and inflammation in the severe form of TBI. Depending on the severity of the injury, there are many different treatment options, from daily cognitive therapy sessions to extreme surgery like bilateral decompressive craniectomies **(Galgano, Toshkezi, Qiu, Russell, Chin & Zhao, 2017).**

Weaknesses in the treatment of individuals with TBI have been found. The articles listed several causes, including poor service quality, a lack of funding, and a systemic inability to offer neuroprotective care. In the early hours after a TBI, it is crucial to involve a condition-specific service with new neuroscience professionals and additional neuro-navigators **(Wade, Nayar and Haider, 2022)**.

Patients with severe TBI have bad prognosis and need effective initial care for enhancing patients' survival. Therefore, providing these patients with high-quality care by nurses can enhance their neurological outcomes. To reduce secondary brain injury and enhance outcomes for TBI patients, multidisciplinary teams, regular close monitoring, and effective therapies are required. Different ways are used to manage TBI, which obviously requires the assistance of bedside nurses as well as the other of the ER's medical staff. Although such management might be challenging, nurses should be competent in the delivery of healthcare and possess the necessary knowledge and skills **(Varghese, Chakrabarty, Menon, 2017)**.

Delays in treating TBI patients result in secondary brain injuries that increase morbidity and mortality. In order to provide immediate care management and avoid complications, rapid and proper care in the emergency department (ED) is crucial. Emergency care includes maintaining the airway while protecting the cervical spine, providing care for breathing and ventilation, controlling bleeding, assessing disability, and performing a neurological examination using the Coma Scale of Glasgow, measuring the size and responsiveness of the pupils, management of increased ICP, head of bed elevation and neurosurgical interventions may be used which address both primary and secondary injury associated with TBI and go beyond the implantation of monitoring devices and ventricular catheters **(Zrelak, Eigsti, Fetzick, Gebhardt, Moran, Moyer, Yahya,2020)**

Significance of the study

Over one million people in the United States alone experience a traumatic brain injury (TBI), which affects over 27 million people worldwide

each year. However, barriers and difficulties still exist in relation to the most efficient preventive, acute, rehabilitative, and long-term care strategies, despite significant advances in understanding TBI over the previous ten years **(Lancet Neurol, 2022)**.

For neurologists, neurosurgeons, and neuro-nurses, developing effective nursing treatment techniques for individuals with severe traumatic brain injury (STBI) remains a challenging task. The list of acceptable justifications and the scientific basis for nursing care of these patients are constantly changing. Patients with STBI have poor prognosis and require quality care for maximizing patients' survival **(Varghese, Chakrabarty, Menon, 2017)**. Nurses are vital to providing patients with mild to severe traumatic brain injury neuroprotective nursing care. For patients to receive safe, high-quality care, nurses must be knowledgeable about the early neuroprotective nursing care. Also, according to Mansoura University statistical report, the total population who was admitted to Emergency hospital was 140000 cases by year, so it is important to implement initial neuroprotective nursing care for traumatic brain injury patients.

Aim of the study:

The purpose of the study is to evaluate the effect of implementing initial neuroprotective nursing care on outcomes of traumatic brain injury patients.

Hypothesis

Patients who will receive initial neuroprotective nursing care will have an improvement on their outcomes as (physiological parameters, GCS, Revised trauma score, temperature, pupil size, equality and reaction, and survival) compared with patients who receive routine care only.

Operational definition:

Initial neuroprotective nursing care means implementation of the neuroprotective nursing care for the first four hours for each patient admission to emergency department. It includes respiratory management, hemodynamic management, and intracranial management.

Subjects and Method

Design

The current study used a quasi-experimental two group (pretest/posttest) design. The effect of one or more independent factors on the dependent variables is investigated in this design. In terms of baseline (pre-intervention) characteristics, quasi-experimental designs choose a comparison group that is as comparable as feasible to the intervention group (**Rogers & Révész, 2020).**

Setting

The study was carried out at Mansoura University's Emergency Hospital's Emergency Department (ED). The emergency department has two rooms: one for medical and one for accident resuscitation. The modern technology, supplies, and equipment needed for emergency services are all present in these rooms, including cardiac monitors, defibrillators, oxygen treatment, suction, and crash carts. Patients with polytrauma, cardiac arrest, and those in need of urgent treatment are treated in these rooms. In the two resuscitation rooms that were chosen, the nurse-to-patient ratio is almost 1:2.

Sample

The study involved a convenience sampling of 78 patients aged ≥ 18 years of both genders who were admitted to the previously mentioned setting. The patients classified into two equal groups, study, and control group, 39 patients in each group and they were included in this study according to the following criteria:

Inclusion criteria

Patients aged ≥18 years with GCS ≤ 12 were included in this study.

Exclusion criteria

Patients who experienced cardiovascular disorders, metabolic disorders and previous history of neurological disorders or had a history of addiction were excluded from this study.

Study group: involved the patient who had received the initial neuroprotective nursing care.

Control group: involved the patient who had received the routine nursing care only.

Sample size calculation

Sample size was determined by using the online Power analysis program of the **Statistics Kingdom**, and based on the study findings of **Thitasawadchaikan, Siripitayakunkit, Norasan, & Kinthorn, (2020)**, the effect size was large (0.8), study power at 0.90, and the α error set at 0.05. The minimum acceptable sample size was 34 for each group. An additional 15% was added to allow participants to drop out of the study, resulting in the final sample size of 39 for each group. Total population admission was 140000 cases by year.

Data Collection Tool

One tool was used in this study to collect data**.**

Initial Traumatic Brain Injury Patients' Assessment tool

This tool was developed by researchers after reviewing recent pertinent literature. It consisted of three parts as follows: -

Part I: Patient's Demographic Data

This part was used to address the patient's personal profile at admission as age, gender, marital status, and occupation.

Part II: Patient's Health Profile Data

This part focused on the patient's past medical history, type of trauma, cause of injury, GCS categories, revised trauma score, CT diagnosis, physiological parameters at admission such as (HR, respiratory rate (RR), temperature, Systolic blood pressure (SBP), mean arterial pressure (MAP), oxygen saturation, and $ETCO_2$), pupil size, pupil equality and reactivity.

Part III: Patient's Outcome Evaluation data

This part was used to evaluate the effect of implementing the initial neuroprotective nursing care on the outcome of TBI patients. This part included the patient's physiological parameters, GCS, Revised trauma score, temperature, pupil size, equality and reaction, and survival until discharge from the ED.

Validity and Reliability

Experts from Mansoura University's Critical

Care and Emergency Nursing Department evaluated the tool's content validity. Their suggestions and criticism were taken into account. While the Cohen's kappa test was used to evaluate the tool's inter-observer reliability in order to assess the validity of the GCS and pupil equality components. The result of Cohen's kappa equals 1 with a *P*-value of 0.025. However, the dependability of physiological measures was evaluated using the intraclass correlation coefficient test. The result was 0.99 with a P-value of < 0.001 indicating perfect agreement between both observers (the researchers and emergency health care provider measured the same item at the same time and their results were compared.)

Pilot Study

An evaluation of the clarity, viability, and applicability of the data collecting tool was conducted in a pilot study with 10 % of the total sample from the emergency department at the Emergency Hospital of Mansoura University. The study sample did not include those patients.

Ethical Considerations

Ethical approval will be obtained from the Research Ethics Committee of the Faculty of Nursing, Mansoura University (Ref. No. P. 0422, date 20/2/2023). Informed consent was obtained from the patient’s next of kin at admission after explaining the nature, benefits, and risks of the study.

The next of kin were made aware that participation in the study was entirely voluntary and that they had the option of approving or rejecting their loved ones' involvement. Additionally, they were made aware of their unrestricted ability to remove their patients from the study at any time. Furthermore, they received assurances that the patients' private information would be kept private because there was no connection between the names of the patients and the data acquired.

Data Collection Process

It included three phases as follows: -

Preparation phase

The administrative authorities of the Emergency Hospital granted official permission for the study's conduct. The data collection instrument and informed consent were obtained, and the authenticity and dependability of the tool's content were verified. To compile the initial neuroprotective nursing care measures given to TBI patients, the researchers review the recent pertinent literature.

Intervention phase

During this phase, the researchers began screening all patients admitted to the ED to ensure they did not meet the exclusion criteria. Following this, part I and part II of the tool were used to collect the patients' demographic and health profile data. Additionally, the patients were assigned using a lottery randomization procedure by selecting one of two cards with the labels "group A" (the study group) or "group B" (the control group) on them.

The study group patients received the initial neuroprotective nursing care in the initial four hours from admission to the ED. Implementation of the initial neuroprotective nursing care lasted for the first four hours for each patient admission.

This intervention was adopted from Promlek, Currey, Damkliang, and Considine (2020) that based on international evidence-based recommendation (American College of Surgeons, 2015; Carney et al., 2016; National Institute for Health and Care Excellence, 2014). This initial neuro-protective nursing care implementation focuses on respiratory management, hemodynamic management, and intracranial management. Respiratory management includes maintaining PaO2 ≥ 97.5 mmHg, PaCO2 35–45 mmHg, SpO2 ≥ 95 and monitor end-tidal carbon dioxide. While the hemodynamic management includes maintain MAP≥80 mmHg and SBP ≥ 100 mmHg by infusion of fluid and vasopressor as prescribed. Intracranial management that includes (keep 30° head of bed elevated, remove cervical collars as soon as possible, maintain normothermia (36–37.5°C) and pain and agitation management). Each patient received nursing intervention for duration of 45 to 120 minutes. Patients in the control group received standard hospital care, which included attaching them to a bedside monitor, doing CT, giving those IV fluids, and performing endotracheal intubation if necessary.

Evaluation phase

Both studied group' physiological parameters, GCS, pupil size, equality, and survival till discharge from the ED were monitored throughout this phase using part III of the tool. These variables were checked immediately after the study group had the neuroprotective nursing care and immediately after the control group received the usual care. A comparison between study and control groups was done before and post neuroprotective nursing care regarding the mentioned parameters.

Data Analysis

Data were gathered and transformed into special design forms for computerization. The Statistical Package of Social Sciences (SPSS) version 20 was used to enter and analyze data. The demographic information of the patients was described using descriptive statistics that were expressed as frequencies (n), percentages (%), means, and standard deviations. The Kolmogorov-Smirnov test was used to determine the normality of the study's data. Pairwise comparisons of normally distributed variables were made using the t-test, whereas comparisons between unrelated groups were made using the independent t-test. The qualitative data of the two groups were compared using the Chi-Square test or Fisher's exact test. If the p value for any of the applied tests was less than 0.050, the results were deemed statistically significant.

Results

Table 1 presents the demographic characteristics of the studied sample. The results showed that nearly half of the study and the control groups (46.2% &43.6. %, respectively) were in the age group between 30-<50years old. While most of the study and the control groups were males (71.8. % & 82.1 % respectively). Only half of the patients in the study group (51 %) were employed compared to 59 % in the control group. Additionally, 66.7% &71.8 % of both groups were single. No statistically significant differences were detected between both groups regards the age, gender, marital status, and occupation (P = 0.471, 0.282, 0.624&0.356 respectively) indicating the similarity of the studied groups before the

intervention.

Table 2 shows the studied groups health profile data**.** The results reveal that the majority of the study and control groups had single trauma that was caused by road traffic accidents (79.5% & 89.7% respectively). Most of the study and control groups (84.5% & 79.5%, respectively) had medical history of comorbidities. According to the revised trauma scale categories, most of the study group and control group (79.5% & 66.6.% respectively) needed immediate care. Concerning the GCS categories, 79.5% of the study group compared with 64.1.% of the control group had a severe TBI. No statistically significant differences were noted between the studied groups regarding their health profile data.

Table 3 compares pupil equality, size, and reactivity to light between the studied groups. According to the findings, there was a statistically significant difference between the two groups on pupil equality on admission and follow-up (P = 0.001). After the intervention, equal pupils were seen in 87.2% of the study group and 20.5% of the control group, compared to 15.4% and 20.5%, respectively, on admission.

Besides, patients in the study group had normal pupil (82.1%) more than patients in the control group (71.8%) post the intervention with statistically significant difference (p = 0.026). Moreover, there was a highly statistically significant difference between both groups on admission and follow up as regards the pupil reactivity (P<0.001). Reactive pupils were observed in 89.7.9% of patients in the study group versus 43.6.% in the control group post the intervention compared to 48.7% and 41% respectively on admission.

Table 4 Compares the GCS on admission and after the intervention in relation to total Glasgow Coma Score between the studied groups. According to the findings, there was no statistical difference with the mean of about 7.38 and 7.30 respectively for both groups. However, on follow-up, a significant improvement in the GCS was observed in the study group after the implementation of the intervention (P=0.001).

Table 5 compares the RTS on admission and after the intervention between the studied groups. The results showed that the mean of the RTS among the study group and the control group on admission is about 2.3 with no statistical difference between them. However, on follow-up, a significant improvement in the RST was observed in the study group after the implementation of the intervention (P=0.011).

Table 6 compares the physiological parameters between patients in the studied groups. The results illustrated a marked improvement in physiological parameters of patients with severe TBI in the study group after the implementation of neuroprotective nursing intervention compared with patients in the control group. This improvement was noted in the SBP, HR, MAP, O2 sat and ETCO2 (102.56±8.95, 88.51±3.24, 84.87±7.92,96.82±9.81&38.30±3.24 respectively).

Table 7 portrays the patients' survival on follow-up. After the execution of the care, all patients in the study group were still alive, while only two cases (15.4. %) in the control group died. Thereby, these differences between patients in both groups who are still alive are statistically significant as a result.

Table (1): Distribution of the studied ICU traumatic patients according to their demographic features:

Items	Study group N= (39)		Control group N= (39)		P-value
	No.	%	No.	%	
Age					
• 18-<30	11	28.2	9	23.1	0.471
• 30-<50	18	46.2	17	43.6	
• ≥50	10	25.6	13	33.3	
$\bar{X}$**(SD)**	36(11.29)		37.84(11.22)		
Gender					
• Male	28	71.8	32	82.1	0.282
• Female	11	28.2	7	17.9	
Marital status					
• Single	26	66.7	28	71.8	0.624
• Married	13	33.3	11	28.2	
Occupation					
• Employed	20	51.3	23	59.0	0.326
• Unemployed	17	43.6	16	41.0	
• Retired	2	5.1	----	----	

P-value of chi square, **t***: Independent t-test * Statistically significant at $p < 0.05$.

Table (2): Studied Groups Health Profile Data

Items	Study group N= (39)		Control group N= (39)		P-value
	No.	%	No.	%	
Type of Trauma					
• Single	31	79.5	35	89.7	0.209
• Multiple	8	20.5	4	10.3	
Cause of Injury					
• Road traffic accidents	31	79.5	35	89.7	0.209
• Assault	8	20.5	4	10.3	
Past Medical History					
• Presence of medical history	33	84.5	31	79.5	0.760
• No medical history	6	15.4	8	20.5	
Computed tomography diagnosis*					
• Subdural Hematoma	25	64.1	23	59	0.642
• Subarachnoid Hemorrhage	26	66.7	28	71.8	0.624
• Intracerebral Hemorrhage	10	25.6	12	30.8	0.615
• Contusion	8	20.5	5	12.8	0.362
Revised trauma score					
• Urgent	8	20.5	13	33.3	
• Immediate	31	79.5	26	66.6	
GCS categories					
• Moderate	8	20.5	14	35.9	
• Severe	31	79.5	25	64.1	

* Multiple response question, P-value of chi square, **t***: Independent t-test *Statistically significant at $p < 0.05$.

Table (3): Comparison between the study and control groups on admission and after the intervention in relation to pupil equality, size, and reaction.

Items	Study group N= (39)		Control group N= (39)		P-value
	No.	%	No.	%	
Pupil equality on admission					
• Equal	6	15.4	8	20.5	0.555
• Unequal	33	84.6	31	79.5	
Pupil equality post the intervention					
• Equal	34	87.2	8	20.5	<0.001
• Unequal	5	12.8	31	79.5	
Pupil size on admission					
• Normal	25	64.1	27	69.2	0.460
• Dilated	5	12.8	7	17.9	
• Pinpointed	9	23.1	5	12.8	
Pupil size post the intervention					
• Normal	32	82.1	28	71.8	0.026
• Dilated	7	17.9	6	15.4	
• Pinpointed	----	----	5	12.8	
Pupil Reaction on admission					
• Both	19	48.7	16	41	0.495
• None	20	51.3	23	59	
• One right	-----	-----	-----	-----	
• One left	-----	-----	-----	-----	
Pupil Reaction post the intervention					
• Both	35	89.7	17	43.6	<0.001
• None	4	10.3	22	56.4	
• One right	5	12.8	-----	-----	
• One left	-----	-----	-----	-----	

P-value of chi square**,** statistically significant at $p < 0.05$.

Table (4): Comparison between the study and control groups on admission, and after the intervention in relation to total Glasgow Coma Score (GCS)

Items	Study group N= (39)		Control group N= (39)		Significance test
	$\overline{X}$	SD	$\overline{X}$	SD	
On admission (Baseline measure)	7.38	1.51	7.30	1.45	t*=0.229 P= 0.820
Post the intervention	8.48	1.50	7.35	1.47	t*=3.34 P=0.001
P-value between two successive measurements	t**=5.16 P ≤0.001*		t**=1.43 P =0.160		

t** paired t test, **t***: Independent t-test * Statistically significant at $p < 0.05$.

Table (5): Comparison between study and control group on admission, after the intervention according to Revised Trauma Score (RTS).

Items	Study group N= (39)		Control group N= (39)		Significance test
	$\overline{X}$	SD	$\overline{X}$	SD	
On admission (Baseline measure)	2.33	0.47	2.38	0.49	t*=0.467 P= 0.642
Post the intervention	2.74	0.44	2.46	0.50	t*=2.62 P=0.011
P-value between two successive measurements	t**=5.14 P ≤0.001*		t**=1.78 P =0.083		

t** paired t test, **t***: Independent t-test * Statistically significant at p < 0.05.

Table (6): Comparison between study and control group on admission and after the intervention according to physiological parameters.

Items	Study group N= (39)	Control group N= (39)	Significance test
	$\overline{X}$ (SD)	$\overline{X}$ (SD)	
Respiratory rate			
• On admission (baseline measure)	25.87(7.76)	24.12(8.71)	t*=0.933 P= 0.354
• Post the intervention	19.66(1.92)	23.35(6.50)	t*=3.39 P ≤0.001
P-value between pre and post of the intervention	t**=4.85 P ≤0.001*	t**=0.629 P =0.533	
Systolic blood pressure			
• On admission (baseline measure)	87.61(12.39)	85.92(11.81)	t*=0.617 P= 0.539
• Post the intervention	102.56(8.95)	87.84(13.08)	t*=5.79 P ≤0.001
P-value between pre and post of the intervention	t**=6.93 P ≤0.001*	t**=0.949 P =0.349	
Heart rate			
• On admission (baseline measure)	108.12(19.74)	105.61(23.00)	t*=0.518 P= 0.606
• Post the intervention	88.51(3.24)	101.97(20.98)	t*=3.95 P ≤0.001
P-value between pre and post of the intervention	t**=6.37 P ≤0.001*	t**=1.138 P =0.262	
Mean arterial blood pressure			
• On admission (baseline measure)	75.43(7.95)	73.23(4.51)	t*=1.50 P= 0.136
• Post the intervention	84.87(7.92)	74.0(5.02)	t*=7.23 P ≤0.001
P-value between pre and post of the intervention	t**=5.50 P ≤0.001*	t**=0.974 P =0.336	
Temperature			
• On admission (baseline measure)	38.96(0.64)	38.83(0.56)	t*=0.933 P= 0.354
• Post the intervention	37.22(0.73)	38.1(0.80)	t*=5.51 P ≤0.001
P-value between pre and post of the intervention	t**=10.29 P ≤0.001*	t**=4.33 P ≤0.001	
Oxygen saturation			
• On admission (baseline measure)	77.76(6.82)	75.82(4.59)	t*=1.47 P= 0.143
• Post the intervention	96.82(9.81)	76.94(3.45)	t*=11.92 P ≤0.001
P-value between pre and post of the intervention	t**=9.99 P ≤0.001*	t**=1.43 P =0.160	
ETCO2			
• On admission (baseline measure)	42.17(5.78)	42.74(5.24)	t*=0.451 P= 0.653
• Post the intervention	38.30(3.24)	42.0(5.32)	t*=3.69 P ≤0.001
P-value between pre and post of the intervention	t**=4.10 P ≤0.001*	t**=0.683 P =0.499	

t** paired t test, **t***: Independent t-test * Statistically significant at p < 0.05.

Table (7): comparison between study and control group regarding clinical outcomes (patient survival)

Items	Study group N= (39)		Control group N= (39)		Significance test
	No.	**%**	**No.**	**%**	
Patient Survival					
• **Still alive**	39	100	33	84.6	**FE** P= 0.025
• **Died**	----	----	6	15.4	

FE: Fisher exact test, * Statistically significant at $p < 0.05$.

Discussion:

Critical care nurses are the health professionals who see the full impact of TBI and have the skills to change the course of a patient's recovery. Therefore, nurses as health care team members are the best positioned to detect and prevent complications associated with TBI and to improve the patient's clinical outcomes through the application of neuro-protective nursing care to those patients **(Mohamed, Hamad, & Mohamed, 2020)**. Therefore, the purpose of this study is to ascertain how early neuroprotective nursing care affects TBI patients' outcomes. As regards the demographic characteristics, the chi square test results indicated no statistically significant differences regarding all demographic features between the study and control groups, which indicate the homogeneity of both groups.

This homogeneity is the basic requirements for any case-control study as revealed by two compatible studies **(Gaoet al., 2021; Othman, Mohamed, El-Soussi, Abd El-Monaem, & Ahmed,2020**), who reported that ‘‘there were no statistically significant differences in all descriptive characteristics between the study and control groups.’’

The findings on the health profiles of the study groups indicated that the majority of both study groups had a single trauma, which is consistent with **Watanitanon et al. (2018)**. Additionally, TBI in both groups was primarily brought on by automobile incidents. The Central Agency for Public Mobilization and Statistics **(CAPMAS) 2020**, reports that the number of auto accidents increased in Egypt by 17.8 percent in 2019, with human error being the main contributor. Moreover, **Verma, Kumar, Jain, Gouda, and Kumawat (2021)** revealed that the RTA was the most frequent cause of traumatic brain injury

The majority of the study group and the control group had a significant number of prior comorbidities. This result conflicts with research by **Robba et al., published in 2020**, which said that "most of their studied patients had fewer co-morbidities."." In the current study, the revised trauma score was immediate in a large percentage of both study groups. This could be because the majority of the patients received emergency care in an ambulance. This is consistent with other research findings **(Mansour, AbouEisha,& Asaad, 2019; Verma et al., 2021)**.

The initial GCS is an important predictor of neurological prognosis and survival in TBI patients. A greater fatality rate was observed in TBI patients with a lower baseline GCS at admission **(Algethamy, 2020)**. Moreover, it is very useful because low GCS scores correlate well with TBI severity **(Tenovuo et al., 2021)**.

The current study results revealed a significant improvement in the GCS was observed in the study group after the implementation of the intervention than that of the control group; the difference was statistically significant. This outcome is consistent with another study by **Mohamed et al. (2020),** entitled "Effect of Implementing Standardized Designed Nursing Guidelines on Outcomes of Severe Traumatic Brain Injury Patients", which exhibited a highly significant increase in GCS on the seventh day between the study group and the control group.

The Revised trauma score (RTS) could be used as a predictor of ICU admission. Thus, one of the main goals of intensive nursing care is improving RTS **(Attia, Elzehery, Ahmed, & Mohamed, 2021)**. The current study revealed homogeneity of RTS among the study group and the control group on admission, which is compatible with **Mohamed et al. (2020)**. Since then, the Glasgow Coma score, systolic blood pressure, and respiration rate have been the three components of the updated trauma score. So, any observable improvements in the three categories indicate the efficacy of the delivered intervention. Fortunately, the current study reported significant improvements regarding the RST and its component categories in the study group after the implementation of the intervention. Matching the results of (**Awad, Ahmed, &Kandeel 2022; Mohamed et al., 2020),** who demonstrated statistically significant improvements in the GCS, SBP, and respiratory rate after implementing their interventions in the study group compared with minimally insignificant changes in the control group.

Pupil size and reactivity are other significant predictors of TBI patients' outcomes. As well, measuring the pupils' constriction rate might have a benefit for monitoring the consciousness level in patients with a lower GCS **(Okidi et al., 2020)**. Thus, the current study assessed the pupil characteristics in both TBI groups and indicated statistically significant differences between both studied TBI groups post-intervention as regards pupil equality (P <0.001), pupil size (P =0.026), and the pupil reaction to light (P<0.001). This conclusion is congruent with the study results of **Awad et al. (2022)** who reported "statistically significant improvements between the studied two groups regarding pupil equality and reactivity following the implementation of their care bundle."

A traumatic brain injury patient's chance of survival greatly depends on the scores of physiological parameters and the level of oxygen saturation. Low levels of SPO2 and MAP have been seen to be associated with poorer clinical outcomes **(Para et al., 2018)**. After the intervention was put into place, the results of the current study showed a considerable improvement

in all physiological parameters for TB patients in the study group compared to those in the control group, with highly statistically significant differences at (P≤0.001). This conclusion is confirmed by two studies (**Mohamed et al., 2020; Froutanet al., 2020),** who noticed a significant improvement in the hemodynamic parameters in the study group versus the control group, with a statistically significant difference on follow-up. It may be proposed that the frequency of nursing assessment of vital signs improved as a result of the application of neuroprotective nursing care that focused on the importance of adequate oxygenation and ventilation in patients with TBI and the importance of blood pressure monitoring and assessment of respiratory rates.

According to the findings of this study, no one in the study group died after the implementation of the initial neuroprotective nursing care, compared to six TBI patients who died in the control group. This finding is supported by the results of **Awad et al. (2022),** which illustrated the same potential benefits for patients who received the targeted intervention in the ICU, including improved physiological parameters, pupil characteristics, and survival rates.

Conclusion and Recommendation

The integration of the initial neuro-protective nursing care improves TBI patients' outcomes, including physiological parameters, GCS, pupil size and reactivity, and survival. After patients are admitted to the ICU, the mortality rate is reduced by the early application of the initial neuro-protective nursing care. Additionally, we proposed that utilizing the initial neuro-protective nursing care facilitates the implementation of patient care. Future research is needed to determine the long-term impact of the initial neuro-protective nursing care on TBI patients in various settings.

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